(19)日本国特許庁（JP）　(12)特　許　公　報（B2）　(11)特許番号

第2617054号

(45)発行日　平成9年(1997)6月4日　(24)登録日　平成9年(1997)3月11日

(51)Int.Cl.⁶	識別記号	庁内整理番号	FI	技術表示箇所
G02B 26/08			G02B 26/08	E
6/26			6/26	
H01L 31/0232			H01L 31/02	C

請求項の数1（全 4 頁）

(21)出願番号　特願平3－271013

(22)出願日　平成3年(1991)10月18日

(65)公開番号　特開平5－107485

(43)公開日　平成5年(1993)4月30日

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(56)参考文献　特開　昭55－142307（JP，A）
特開　平1－102515（JP，A）

(54)【発明の名称】　光接続モジュール

(57)【特許請求の範囲】

【請求項1】　光ファイバと縦方向及び横方向の2軸に独立に回転可能なミラーとを二次元配列し、更にそれらの間に受光素子を配列した基板を用い、一方の基板の光ファイバの端面と他方の基板の反射ミラーとが互いに向き合うように一定の間隔をおいて対向させ、前記受光素子によって光の位置を検出して、一方の基板の光ファイバから出た光を他方の基板の反射ミラーで反射させ、この光を対向する基板上の光ファイバまたは反射ミラーに光を当てることにより、任意の光ファイバ同士を光接続することを特徴とする光接続モジュール。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は光通信の分野において、複数の光ファイバ間で光信号を切り換える光接続モジュールに関するものである。

【0002】

【従来の技術】従来、二次元ファイバアレイ間で光信号を切り換える空間接続では，図4に示すように，二次元ファイバアレイを配置した基板1の間に、幾つかのビームシフタ2を設置した構成になっている。この構成では，光ファイバ3から出てきた光が，マイクロレンズ4によって平行な光ビーム5に変換され，すべてのビームシフタ2を通過してから，最後に他方のファイバアレイに到達する。光ビーム5はビームシフタ2を通過するとき電気信号の有無によって，その進路が変えられ，進路変更を受けた光ビーム5は，ビームシフタ2内の幾つかに分割されているセクションを一つだけ隣に移動する。したがって、ビームの進路を大きく変えるためには、多くのビームシフタが必要になる。例えば、図4において

一方の二次元ファイバアレイ１の隅のファイバを、他方の二次元ファイバアレイ上で対角の位置にあるファイバに接続する場合、８個のビームシフタが必要になる。このように空間接続する二つの光ファイバの間に多くの部品が存在すると、ファイバ間での光の損失が大きくなるだけでなく、二次元ファイバアレイ１およびビームシフタ２の相互の位置合わせに高精度が必要となるといった問題が起きる。

【０００３】

【発明が解決しようとする課題】本発明は二つの回転反射ミラーを用いることにより、前記の問題を解消する光接続モジュールを提供することにある。

【０００４】本発明の光接続モジュールは、光ファイバと縦方向及び横方向の２軸に独立に回転可能なミラーとを二次元配列し、更にそれらの間に受光素子を配列した基板を用い、一方の基板の光ファイバの端面と他方の基板の反射ミラーとが互いに向き合うように一定の間隔をおいて対向させ、受光素子によって光の位置を検出して、一方の基板の光ファイバから出た光を他方の基板の反射ミラーで反射させ、この光を対向する基板上の光ファイバまたは反射ミラーに光を当てることにより、任意の光ファイバ同士を光接続する。

【０００５】

【実施例】以下、図面を参照して、本発明の実施例を詳細に説明する。図１は光ファイバと回転反射ミラーを二次元に配列したアレイ基板の基本構成を示す斜視図であって、３は光ファイバ、４はマイクロレンズ基板上のマイクロレンズ、６はマイクロレンズ基板上で回転反射ミラーを配置するための開孔、７はマイクロレンズを配置した基板、８は二軸方向に回転できる回転反射ミラー、９は二次元に配列してファイバ３と回転反射ミラー８を保持するアレイ基板である。マイクロレンズ４は光ファイバ３の端面と対向しており、出射光を平行な光ビームに変換する。回転反射ミラー８は縦方向と横方向の二軸に独立で回転可能であるので、ミラー面を任意の方向に向けることができる。

【０００６】図２は光接続モジュールの基本構成を示す斜視図であって、アレイ基板（マイクロレンズ基板７は図示せず）ＡとＢによる接続状態をわかり易くするため、ファイバアレイを傾けた状態で図示している。本来、アレイ基板Ａは、そのファイバと回転反射ミラーが、アレイ基板Ｂの回転反射ミラーとファイバとに一定の距離をおいて平行に対向するように固定される。

【０００７】この構成において、アレイ基板Ａのｉ番目のファイバF_a(i)とアレイ基板Ｂのｊ番目のファイバF_b(j)を接続する場合、ファイバF_b(j)と対向する位置にあるアレイ基板Ｂの上の回転ミラーM_b(i)は、ファイバF_a(i)から出てきた光が、アレイ基板Ａのｊ番目にある回転反射ミラーM_a(j)に当たるように、その角度を設定し、同様に回転反射ミラーM_a(j)は、回転反射ミラーM_a(j)からの反射ビームを、ファイバF_b(j)に伝搬するように調整すればよい。

【０００８】もし回転反射ミラーM_a(j)の反射ビームをファイバF_b(j)ではなく、回転反射ミラーM_b(k)に当て、さらにこのミラーの反射ビームをF_a(k)に照射すると、アレイ基板Ａから出た光を、同じ基板上の他の光ファイバと接続できる。すなわち、２枚の反射ミラーを使うと、出射ビームと対向するアレイ基板上の任意の光ファイバと、また３枚の反射ミラーを使うと、出射ビームと同じアレイ基板上の任意の光ファイバと、それぞれ空間接続ができる。なお、反射ミラーを１枚だけ使う接続も可能で、この場合には、入出射する光ファイバが同じ基板上にあり、かつ光が斜め入射になるので、光伝搬は一方向という制限を受ける。

【０００９】ファイバF_a(i)から出てきた光を、回転反射ミラーM_b(i)で元のファイバF_a(i)に反射ビームを戻す空間接続まで含めて考えると、本発明の光接続モジュールでは、自己を含めモジュールを構成するすべての光ファイバを、相互に空間接続できる。

【００１０】この空間接続における光の損失は、光接続の経路や長さにほとんど関係なく、２枚または３枚の反射ミラーによる反射率だけを考慮すればよく、これに対しては、従来から広く使われている高反射膜の採用により、光の損失は小さくなる。なお、マイクロレンズを透過するときのフレネル反射損に対しても低反射膜を使うことで、その影響を低減できる。

【００１１】また、アレイ基板Ａ，Ｂの相対的な位置およびアレイ基板上に配列する各ファイバの位置については、高精度を必要とせず、ファイバF_a(i)から出た光ビームが、回転反射ミラーM_b(i)に確実に当たるだけの精度があればよい。この理由は、回転反射ミラーM_b(i)で受けた光ビームを、回転反射ミラーM_a(j)で中断し、ファイバF_b(j)に伝搬するとき、いずれも相手の位置に関係なく、回転反射ミラーを角度調整することにより接続できるからである。

【００１２】しかしながら、この方法では、アレイ基板上のビームの位置を知るには、ファイバに光ビームを当てて、その位置を検出することになる。ところが目的のファイバ以外、他のすべてのファイバが接続されていて、これらのファイバに、もう一つの光ビームを当てることができない場合には、ビームの位置検出が困難になるという問題がある。

【００１３】図３は二次元配列基板上でファイバ端面と回転反射ミラーの間に、受光素子１０を配置し、光ビームの位置検出を可能にしたアレイ基板の正面図であって、モジュールの構成は前記と同様に行う。このアレイ基板では、以下のようにして、目的のミラーやファイバに、光ビームを当てることができる。

【００１４】まず、向かい側にあるアレイ基板上の任意の受光素子１０に光ビーム５を当て、当たっている光ビ

ーム位置P_1を検知する。次に、ここから目的とするファイバF_a或いはミラーM_a（図示せず）の位置を計算して、光ビームを走査する。この方法において、この光ビーム走査の際、ビームを直接目的とする例えばファイバF_aに移動するのではなく、先ずその周囲に配置されている四つの受光素子10′の一つで光ビームの位置を検出し、次に光ビームをファイバF_aに走査すると、ファイバF_aと受光素子10′との相対位置が近いことから、目的のファイバF_aに正確に光ビームを当てることができる。

【0015】

【発明の効果】以上説明したように、本発明の光接続モジュールは、アレイ基板上の光ファイバを相互接続する場合、光の進路変更と位置決めには、それぞれのファイバに対向する2枚の回転反射ミラーしか使わないので、操作は簡単であり、光損失も小さい。また、すでに接続されているファイバ間の組合せを変更する場合も、同様にすればよい。しかもファイバの配列やアレイ基板の相対位置に対して高精度を必要としないので、これらの部品の加工や組立が容易になるという効果が期待できる。

【図面の簡単な説明】

【図1】光ファイバと回転反射ミラーを二次元に配列したアレイ基板の基本構成を示す斜視図である。

【図2】2枚のアレイ基板を用いた光の空間接続状態を示す図である。

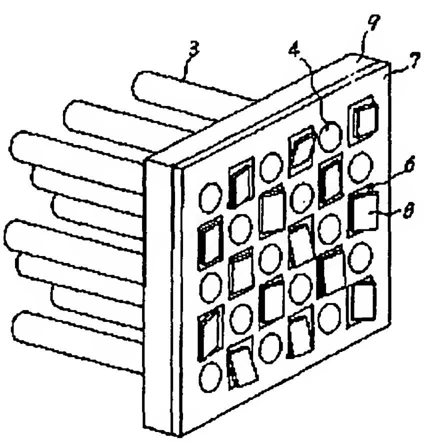
【図3】二次元配列基板でファイバ端面と回転反射ミラーの間に受光素子を配置し、光ビームの位置検出を可能にしたアレイ基板の正面図である。

【図4】ビームシフタを用いた二次元の光接続モジュールの構成を示す斜視図である。

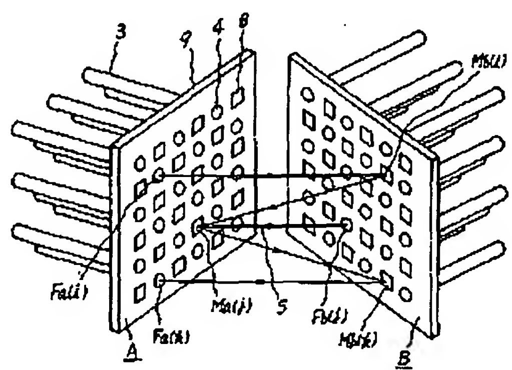
【符号の説明】

1 二次元ファイバアレイ基板
2 ビームシフタ
3 光ファイバ
4 マイクロレンズ
5 光ビーム
6 開孔
7 マイクロレンズ基板
8 回転反射ミラー
9 アレイ基板
10、10′ 受光素子
A、B アレイ基板
F_a、$F_a(i)$、$F_a(k)$、$F_b(l)$ ファイバ
P_1 光ビーム位置
$M_b(l)$、$M_a(j)$、$M_b(k)$ 回転反射ミラー

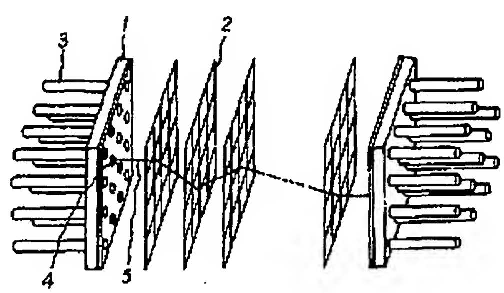
【図1】



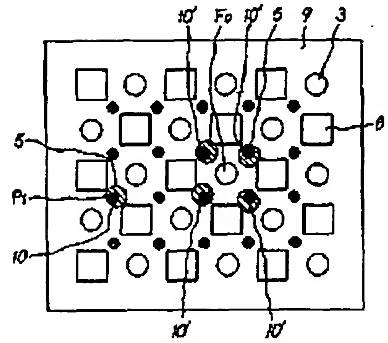
【図2】



【図4】



【図3】



JAPANESE [JP,2617054,B]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

CLAIMS

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(57) [Claim(s)]
[Claim 1] The two-dimensional array of the mirror which can be rotated independently is carried out to biaxial [of an optical fiber, lengthwise, and a longitudinal direction]. Furthermore, set a fixed interval, make it counter so that the end face of the optical fiber of one substrate and the reflective mirror of the substrate of another side may face mutually using the substrate which arranged the photo detector among them, and the aforementioned photo detector detects the position of light. The optical connection module characterized by making optical connection of the arbitrary optical fibers by reflecting the light which came out of the optical fiber of one substrate by the reflective mirror of the substrate of another side, and applying light to the optical fiber or reflective mirror on the substrate which counters this light.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the optical connection module which switches a lightwave signal among two or more optical fibers in the field of optical communication.
[0002]
[Description of the Prior Art] Conventionally, in the space connection which switches a lightwave signal between 2-dimensional fiber arrays, as shown in drawing 4 , it has the composition of having installed some beam shifters 2 between the substrates 1 which have arranged the 2-dimensional fiber array. With this composition, after the light which came out of the optical fiber 3 is changed into the parallel light beam 5 by the micro lens 4 and passes all the beam shifters 2 by it, finally the fiber array of another side is reached. The light beam 5 which the course was changed by the existence of an electrical signal and received course change by it when a light beam 5 passed the beam shifter 2 moves next only one section currently divided into some in the beam shifter 2. Therefore, in order to change the course of a beam a lot, many beam shifters are needed. For example, when connecting the fiber of the corner of one 2-dimensional fiber array 1 to the fiber which is in a diagonal position on the 2-dimensional fiber array of another side in drawing 4 , eight beam shifters are needed. Thus, if many parts exist between two optical fibers which make space connection, loss of the light between fibers not only becomes large, but the problem that high degree of accuracy is needed for the mutual alignment of the 2-dimensional fiber array 1 and the beam shifter 2 will occur.
[0003]
[Problem(s) to be Solved by the Invention] this invention is by using two rotation reflective mirrors to offer the optical connection module which solves the aforementioned problem.
[0004] The optical connection module of this invention carries out the two-dimensional array of the mirror which can be rotated independently to biaxial [of an optical fiber, lengthwise, and a longitudinal direction]. Furthermore, set a fixed interval, make it counter so that the end face of the optical fiber of one substrate and the reflective mirror of the substrate of another side may face mutually using the substrate which arranged the photo detector among them, and a photo detector detects the position of light. Optical connection of the arbitrary optical fibers is made by reflecting the light which came out of the optical fiber of one substrate by the reflective mirror of the substrate of another side, and applying light to the optical fiber or reflective mirror on the substrate which counters this light.
[0005]
[Example] Hereafter, with reference to a drawing, the example of this invention is explained in detail. Drawing 1 is the perspective diagram showing the basic composition of the array substrate which arranged the optical fiber and the rotation reflective mirror to two dimensions, and puncturing for an optical fiber and 4 arranging the micro lens on a micro-lens substrate on a micro-lens substrate, and 3 arranging a rotation reflective mirror, as for 6, the substrate to which 7 has arranged the micro lens, the rotation reflective mirror which 8 can rotate to 2 shaft orientations, and 9 are the array substrates which arrange to two dimensions and hold a fiber 3 and the rotation reflective mirror 8. The micro lens 4 has

countered with the end face of an optical fiber 3, and changes outgoing radiation light into an parallel light beam. Since the rotation reflective mirror 8 can be independent of two shafts of lengthwise and a longitudinal direction and it can rotate, a mirror side can be turned in the arbitrary directions.
[0006] Drawing 2 is the perspective diagram showing the basic composition of an optical connection module, and where a fiber array is leaned, it is illustrated in order to make intelligible the connection state by the array substrates (not shown [the micro-lens substrate 7]) A and B. Originally, the array substrate A is fixed so that the fiber and a rotation reflective mirror may keep a fixed distance from the rotation reflective mirror and fiber of the array substrate B and may counter them in parallel.
[0007] It sets in this composition and is the i-th fiber Fa of the array substrate A. (i) j-th fiber Fb of the array substrate B (j) When connecting, fiber Fa (i) Rotation mirror Mb on the array substrate B in the position which counters (i) fiber Fa (i) from -- rotation reflective mirror Ma which has the light which came out in the j-th of the array substrate A (j) So that it may hit The angle is set up and it is the rotation reflective mirror Ma similarly. (j) Rotation reflective mirror Mb About the reflective beam from (i), it is Fiber Fb. (j) What is necessary is just to adjust so that it may spread.
[0008] It is the rotation reflective mirror Ma. (j) It is Fiber Fb about a reflective beam. (j) Not but, rotation reflective mirror Mb (k) It guesses and is Fa about the reflective beam of this mirror further. (k) If it irradiates, the light which came out of the array substrate A is connectable with other optical fibers on the same substrate. That is, if three reflective mirrors are used again with the arbitrary optical fibers on the array substrate which will counter with an outgoing radiation beam if two reflective mirrors are used, space connection can be performed, respectively with the arbitrary optical fibers on the same array substrate as an outgoing radiation beam. In addition, since there is only one optical fiber which is possible also for the connection using a reflective mirror, and carries out close outgoing radiation in this case on the same substrate and light becomes oblique incidence, on the other hand, optical propagation receives the limit of Mukai.
[0009] fiber Fa (i) from -- the light which came out -- rotation reflective mirror Mb (i) The original fiber Fa (i) If it includes and thinks to the space connection which returns a reflective beam, by the optical connection module of this invention, space connection of all the optical fibers that constitute modules including self will be made mutually.
[0010] To this, loss of light becomes small by adoption of the high reflective film currently widely used from the former that loss of the light in this space connection should take into consideration only the reflection factor by two sheets or three reflective mirrors almost regardless of the path and length of optical connection. In addition, the influence can be reduced by using a low reflective film also to the Fresnel-reflection loss when penetrating a micro lens.
[0011] moreover -- the position of each fiber arranged on the relative position of the array substrates A and B, and an array substrate -- high degree of accuracy -- not needing -- fiber Fa (i) from -- the light beam which came out -- rotation reflective mirror Mb (i) There should be only precision which hits certainly. This reason is the rotation reflective mirror Mb. (i) About the received light beam, it is the rotation reflective mirror Ma. (j) It is interrupted and is Fiber Fb. (j) It is because it can connect when all carry out angle adjustment of the rotation reflective mirror regardless of a partner's position, when spreading.
[0012] However, by this method, in order to know the position of the beam on an array substrate, a light beam will be applied to a fiber and the position will be detected. However, when other fibers are connected [no] and another light beam can be applied to these fibers except the target fiber, there is a problem that position detection of a beam becomes difficult.
[0013] On a two-dimensional-array substrate, between a fiber end face and a rotation reflective mirror, drawing 3 arranges a photo detector 10, is the front view of the array substrate which enabled position detection of a light beam, and performs modular composition like the above. A light beam can be put in this array substrate to a target mirror and a target fiber as follows.
[0014] First, light beam position P1 which applied the light beam 5 to the arbitrary photo detectors 10 on the array substrate in an opposite side, and has hit It detects. Next, fiber F0 made into the purpose from here Or the position of a mirror M0 (not shown) is calculated and a light beam is scanned. Fiber F0

which sets a beam as the direct purpose in this method in the case of this light beam scan It does not move. The position of a light beam is detected by one of the four photo-detectors 10' arranged first at the circumference, and, next, it is a fiber F0 about a light beam. When it scans, it is a fiber F0. The target fiber F0 since the relative position with photo-detector 10' is near A light beam can be applied correctly.
[0015]
[Effect of the Invention] As explained above, when the optical connection module of this invention interconnects the optical fiber on an array substrate, since only two rotation reflective mirrors which counter each fiber are used for course change and positioning of light, operation is easy and its optical loss is also small. Moreover, what is necessary is just to make it the same, when changing the combination between the already connected fibers. And since high degree of accuracy is not needed to the array of a fiber, or the relative position of an array substrate, the effect that processing of these parts and assembly become easy is expectable.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] this invention relates to the optical connection module which switches a lightwave signal among two or more optical fibers in the field of optical communication.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, in the space connection which switches a lightwave signal between 2-dimensional fiber arrays, as shown in drawing 4 , it has the composition of having installed some beam shifters 2 between the substrates 1 which have arranged the 2-dimensional fiber array. With this composition, after the light which came out of the optical fiber 3 is changed into the parallel light beam 5 by the micro lens 4 and passes all the beam shifters 2 by it, finally the fiber array of another side is reached. The light beam 5 which the course was changed by the existence of an electrical signal and received course change by it when a light beam 5 passed the beam shifter 2 moves next only one section currently divided into some in the beam shifter 2. Therefore, in order to change the course of a beam a lot, many beam shifters are needed. For example, when connecting the fiber of the corner of one 2-dimensional fiber array 1 to the fiber which is in a diagonal position on the 2-dimensional fiber array of another side in drawing 4 , eight beam shifters are needed. Thus, if many parts exist between two optical fibers which make space connection, loss of the light between fibers not only becomes large, but the problem that high degree of accuracy is needed for the mutual alignment of the 2-dimensional fiber array 1 and the beam shifter 2 will occur.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, when the optical connection module of this invention interconnects the optical fiber on an array substrate, since only two rotation reflective mirrors which counter each fiber are used for course change and positioning of light, operation is easy and its optical loss is also small. Moreover, what is necessary is just to make it the same, when changing the combination between the already connected fibers. And since high degree of accuracy is not needed to the array of a fiber, or the relative position of an array substrate, the effect that processing of these parts and assembly become easy is expectable.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] this invention is by using two rotation reflective mirrors to offer the optical connection module which solves the aforementioned problem.
[0004] The optical connection module of this invention carries out the two-dimensional array of the mirror which can be rotated independently to biaxial [of an optical fiber, lengthwise, and a longitudinal direction]. Furthermore, set a fixed interval, make it counter so that the end face of the optical fiber of one substrate and the reflective mirror of the substrate of another side may face mutually using the substrate which arranged the photo detector among them, and a photo detector detects the position of light. Optical connection of the arbitrary optical fibers is made by reflecting the light which came out of the optical fiber of one substrate by the reflective mirror of the substrate of another side, and applying light to the optical fiber or reflective mirror on the substrate which counters this light.

[Translation done.]

EXAMPLE

[Example] Hereafter, with reference to a drawing, the example of this invention is explained in detail. Drawing 1 is the perspective diagram showing the basic composition of the array substrate which arranged the optical fiber and the rotation reflective mirror to two dimensions, and puncturing for an optical fiber and 4 arranging the micro lens on a micro-lens substrate on a micro-lens substrate, and 3 arranging a rotation reflective mirror, as for 6, the substrate to which 7 has arranged the micro lens, the rotation reflective mirror which 8 can rotate to 2 shaft orientations, and 9 are the array substrates which arrange to two dimensions and hold a fiber 3 and the rotation reflective mirror 8. The micro lens 4 has countered with the end face of an optical fiber 3, and changes outgoing radiation light into an parallel light beam. Since the rotation reflective mirror 8 can be independent of two shafts of lengthwise and a longitudinal direction and it can rotate, a mirror side can be turned in the arbitrary directions.
[0006] Drawing 2 is the perspective diagram showing the basic composition of an optical connection module, and where a fiber array is leaned, it is illustrated in order to make intelligible the connection state by the array substrates (not shown [the micro-lens substrate 7]) A and B. Originally, the array substrate A is fixed so that the fiber and a rotation reflective mirror may keep a fixed distance from the rotation reflective mirror and fiber of the array substrate B and may counter them in parallel.
[0007] It sets in this composition and is the i-th fiber Fa of the array substrate A. (i) j-th fiber Fb of the array substrate B (j) When connecting, fiber Fa (i) Rotation mirror Mb on the array substrate B in the position which counters (i) fiber Fa (i) from -- rotation reflective mirror Ma which has the light which came out in the j-th of the array substrate A (j) So that it may hit The angle is set up and it is the rotation reflective mirror Ma similarly. (j) Rotation reflective mirror Mb About the reflective beam from (i), it is Fiber Fb. (j) What is necessary is just to adjust so that it may spread.
[0008] It is the rotation reflective mirror Ma. (j) It is Fiber Fb about a reflective beam. (j) Not but, rotation reflective mirror Mb (k) It guesses and is Fa about the reflective beam of this mirror further. (k) If it irradiates, the light which came out of the array substrate A is connectable with other optical fibers on the same substrate. That is, if three reflective mirrors are used again with the arbitrary optical fibers on the array substrate which will counter with an outgoing radiation beam if two reflective mirrors are used, space connection can be performed, respectively with the arbitrary optical fibers on the same array substrate as an outgoing radiation beam. In addition, since there is only one optical fiber which is possible also for the connection using a reflective mirror, and carries out close outgoing radiation in this case on the same substrate and light becomes oblique incidence, on the other hand, optical propagation receives the limit of Mukai.
[0009] fiber Fa (i) from -- the light which came out -- rotation reflective mirror Mb (i) The original fiber Fa (i) If it includes and thinks to the space connection which returns a reflective beam, by the optical connection module of this invention, space connection of all the optical fibers that constitute modules including self will be made mutually.
[0010] To this, loss of light becomes small by adoption of the high reflective film currently widely used from the former that loss of the light in this space connection should take into consideration only the reflection factor by two sheets or three reflective mirrors almost regardless of the path and length of

optical connection. In addition, the influence can be reduced by using a low reflective film also to the Fresnel-reflection loss when penetrating a micro lens.

[0011] moreover -- the position of each fiber arranged on the relative position of the array substrates A and B, and an array substrate -- high degree of accuracy -- not needing -- fiber Fa (i) from -- the light beam which came out -- rotation reflective mirror Mb (i) There should be only precision which hits certainly. This reason is the rotation reflective mirror Mb. (i) About the received light beam, it is the rotation reflective mirror Ma. (j) It is interrupted and is Fiber Fb. (j) It is because it can connect when all carry out angle adjustment of the rotation reflective mirror regardless of a partner's position, when spreading.

[0012] However, by this method, in order to know the position of the beam on an array substrate, a light beam will be applied to a fiber and the position will be detected. However, when other fibers are connected [no] and another light beam can be applied to these fibers except the target fiber, there is a problem that position detection of a beam becomes difficult.

[0013] On a two-dimensional-array substrate, between a fiber end face and a rotation reflective mirror, drawing 3 arranges a photo detector 10, is the front view of the array substrate which enabled position detection of a light beam, and performs modular composition like the above. A light beam can be put in this array substrate to a target mirror and a target fiber as follows.

[0014] First, light beam position P1 which applied the light beam 5 to the arbitrary photo detectors 10 on the array substrate in an opposite side, and has hit It detects. Next, fiber F0 made into the purpose from here Or the position of a mirror M0 (not shown) is calculated and a light beam is scanned. Fiber F0 which sets a beam as the direct purpose in this method in the case of this light beam scan It does not move. The position of a light beam is detected by one of the four photo-detectors 10' arranged first at the circumference, and, next, it is a fiber F0 about a light beam. When it scans, it is a fiber F0. The target fiber F0 since the relative position with photo-detector 10' is near A light beam can be applied correctly.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram showing the basic composition of the array substrate which arranged the optical fiber and the rotation reflective mirror to two dimensions.
[Drawing 2] It is drawing showing the space connection state of the light using two array substrates.
[Drawing 3] It is the front view of the array substrate which has arranged the photo detector between a fiber end face and a rotation reflective mirror by the two-dimensional-array substrate, and enabled position detection of a light beam.
[Drawing 4] It is the perspective diagram showing the composition of the 2-dimensional optical connection module using the beam shifter.
[Description of Notations]
1 2-dimensional Fiber Array Substrate
2 Beam Shifter
3 Optical Fiber
4 Micro Lens
5 Light Beam
6 Puncturing
7 Micro-Lens Substrate
8 Rotation Reflective Mirror
9 Array Substrate
10 10' Photo detector
A, B Array substrate
F0 and Fa (i) Fa (k) Fb (i) Fiber
P1 Light beam position
Mb (i) Ma (j) Mb (k) Rotation reflective mirror

[Translation done.]

* NOTICES *

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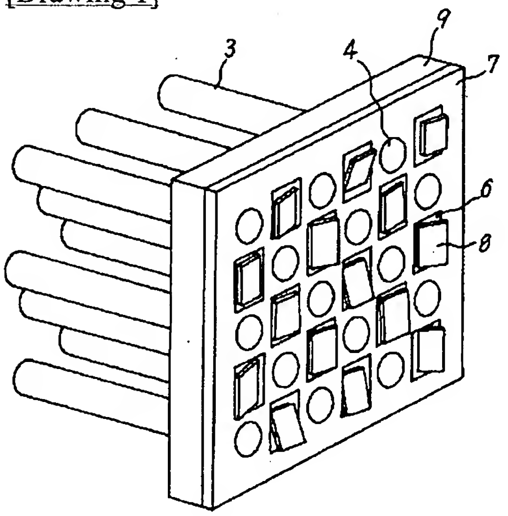
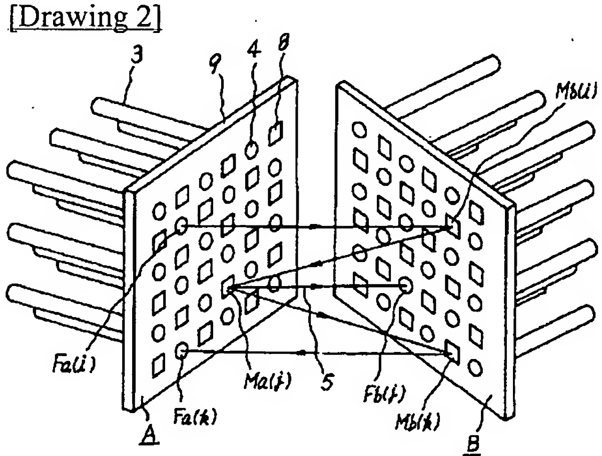
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

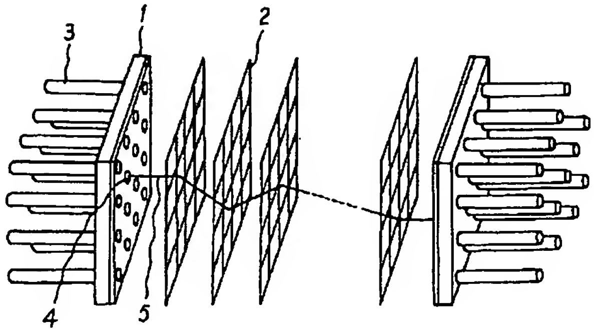
[Drawing 1]



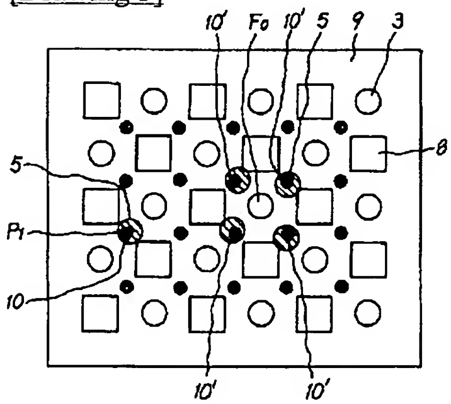
[Drawing 2]



[Drawing 4]



[Drawing 3]



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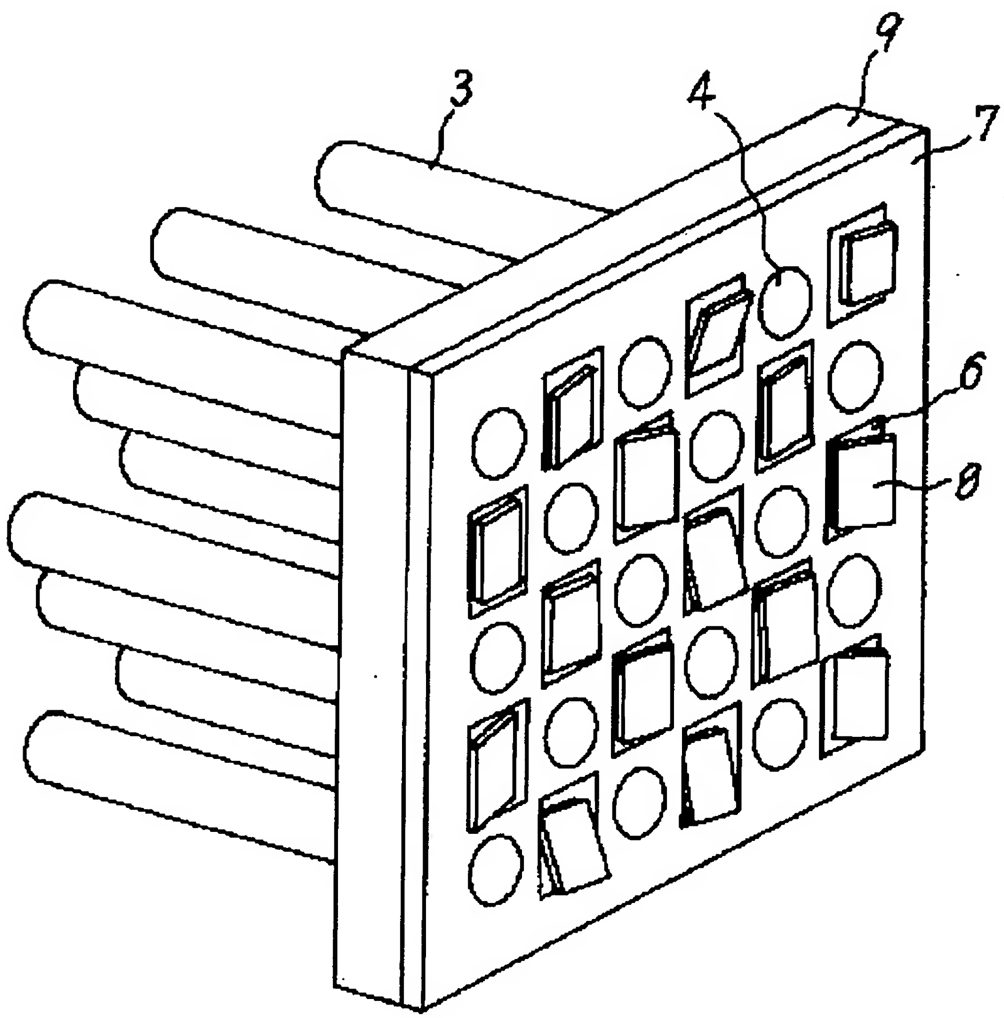
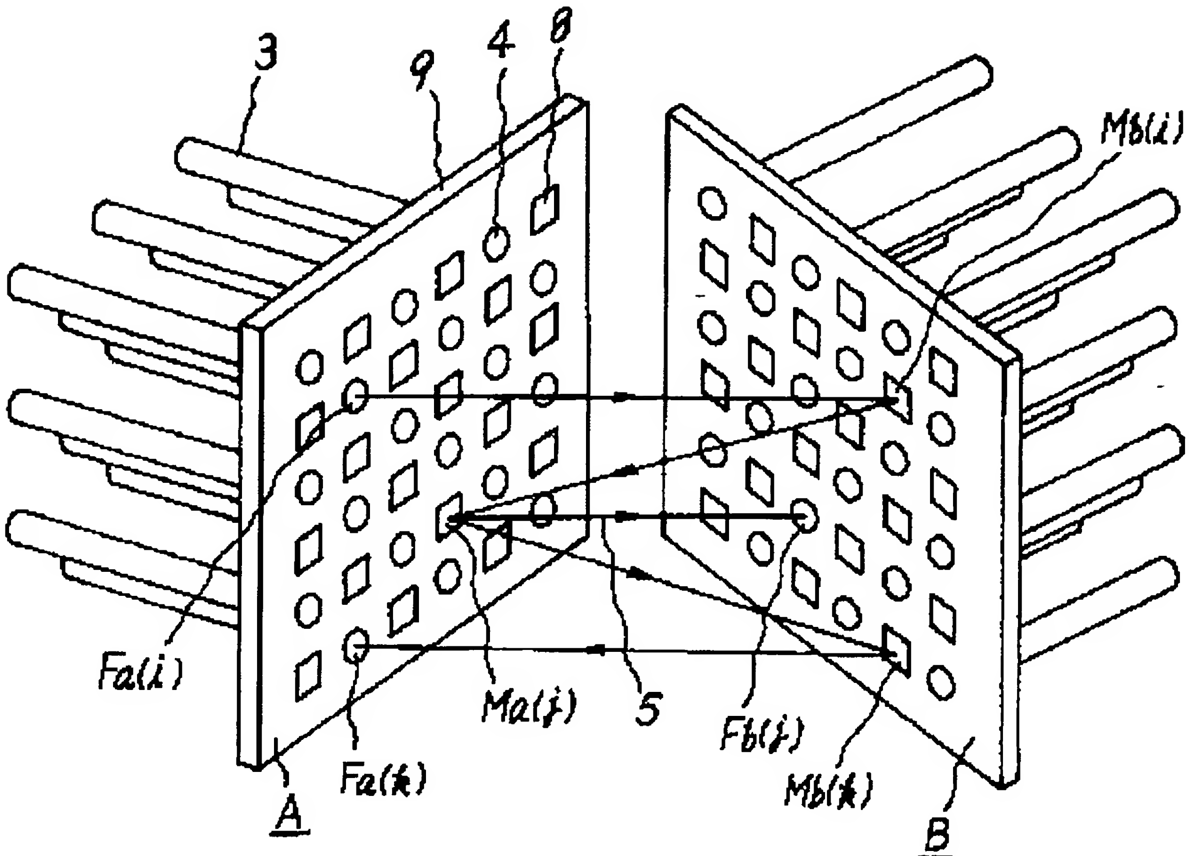
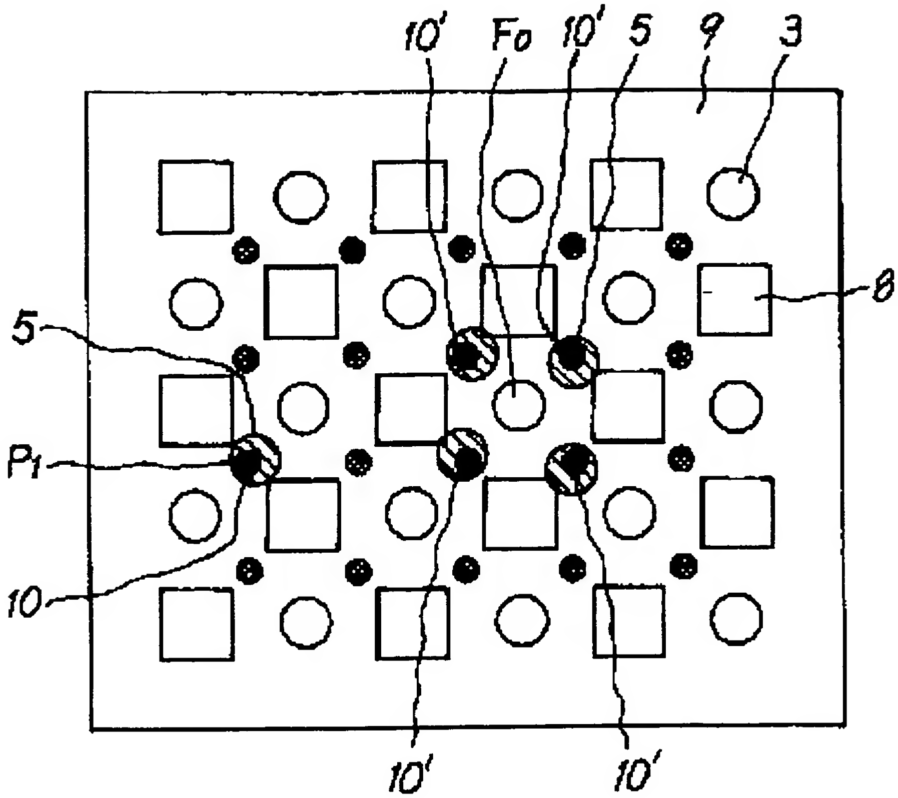
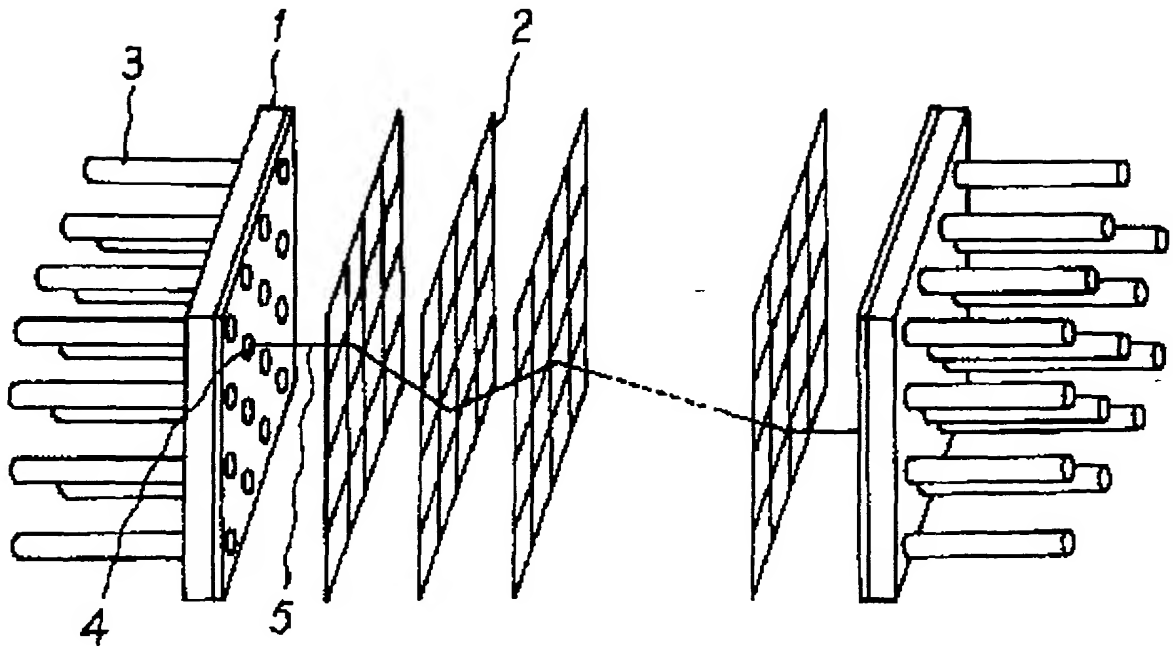


3
4
9
7
6
8


3
9
4
8
Mb(i)
Fa(i)
Ma(j)
5
Fb(j)
Fa(k)
Mb(k)
A
B


10'
Fo
10'
5
9
3
8
5
P1
10
10'
10'


3
1
2
4
5